Didactic Video: Organizational Models of the Electronic Image

Woody Vasulka and Scott Nygren

The tableau images are the results of working with the Rutt/Etra video synthesizer built by Steve Rutt and Bill Etra in 1973. The Vasulkas used this instrument in several of their video works (for example, **Reminiscence** or **C-Trend**). It provided the video effects in which the lighter areas of the frame pull up the lines of the raster to a vertical position which created the illusion of a 3-D space. This real-time system, which electronically alters the deflection signals that generate the TV raster, suggested a new approach to video work, since it required a more precise approach to dealing with the time sequences. Here, the images are frozen for didactic purposes, so to provide a taxonomy of machine imagery, which should serve as a basis for its further creative use and conceptualization.

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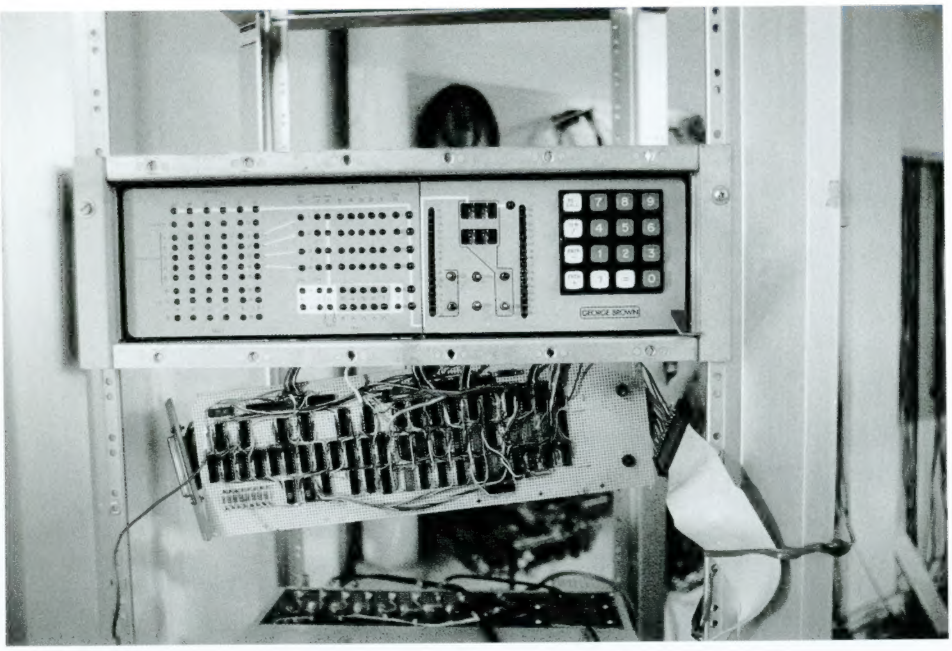
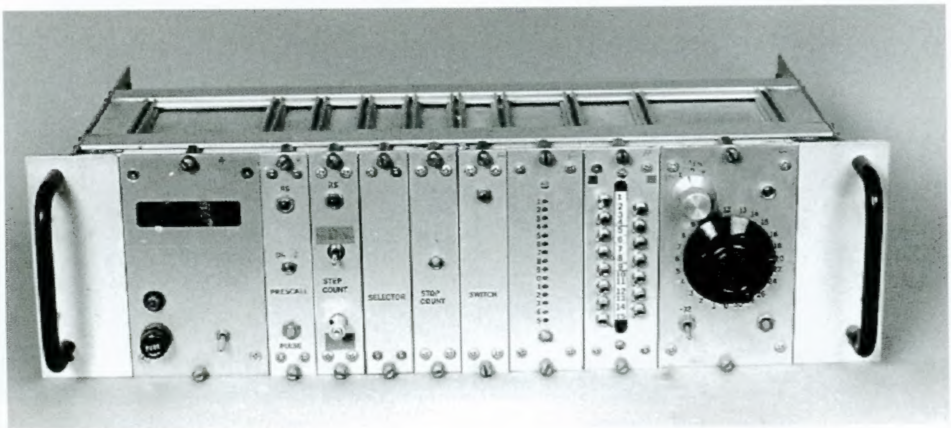
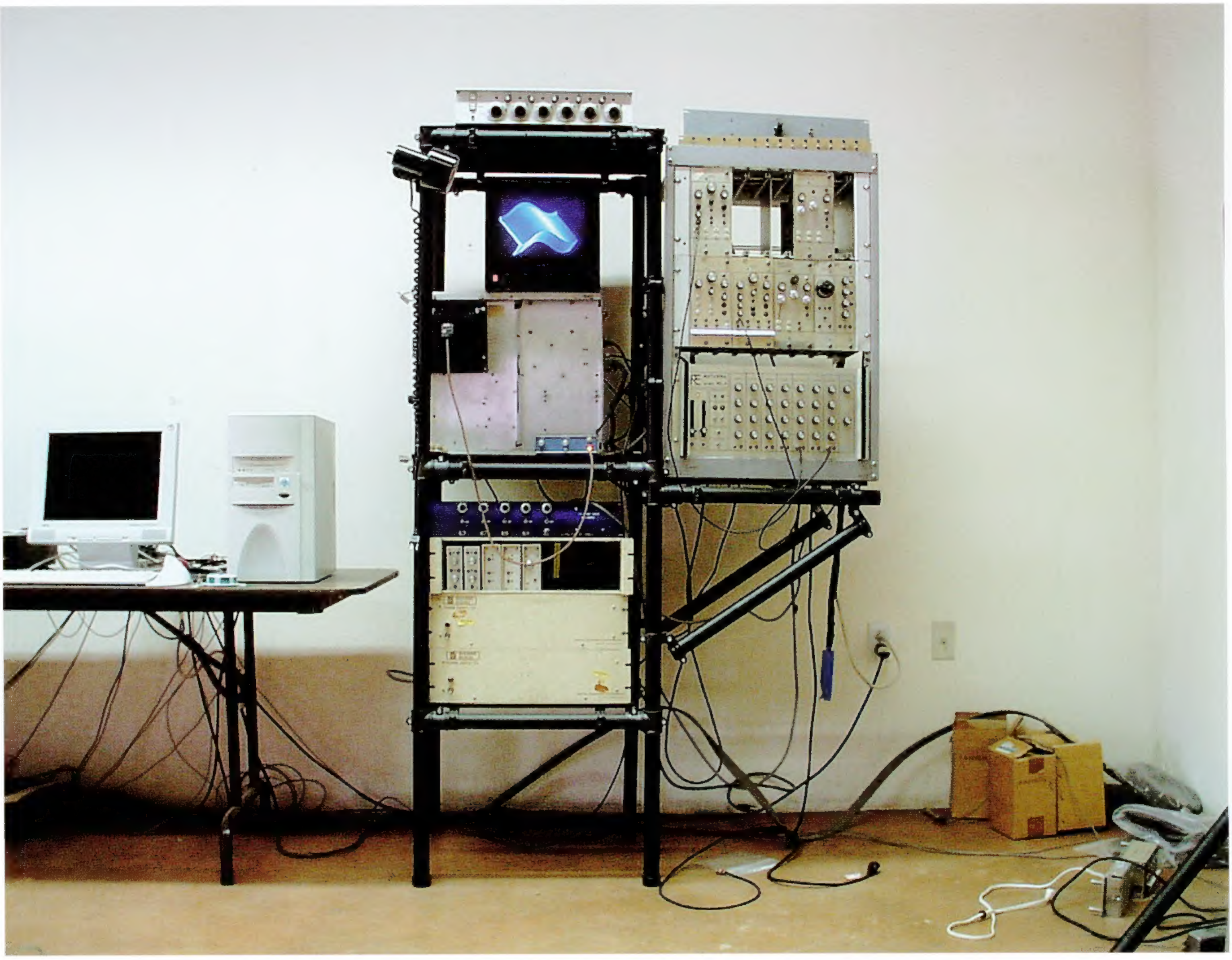


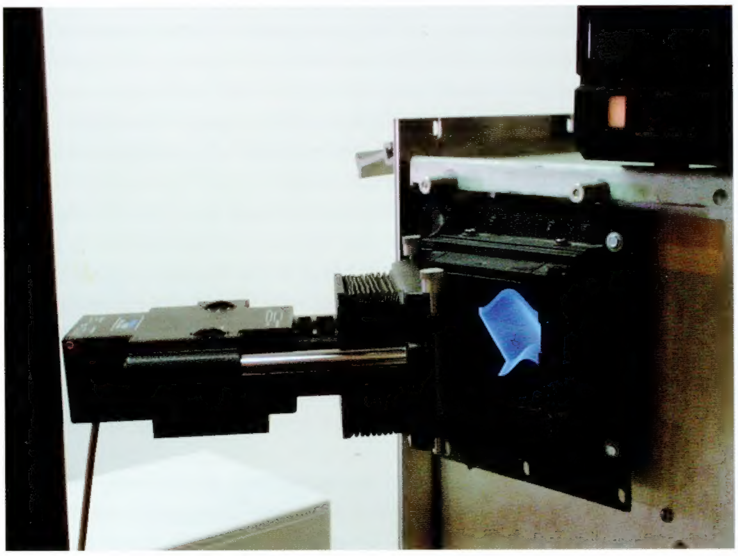
George Brown, Multi-Level Keyer, 1973
This "priority" keyer, designed for Steina and Woody Vasulka, allowed the user to design the relative placement of the layers from front to back. In 1977 a computer interface was added.



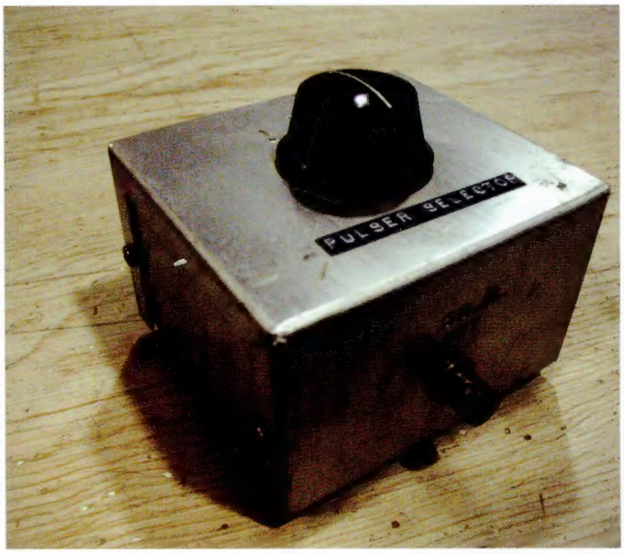
George Brown, Programmable Field Flip Flop Switcher, 1972



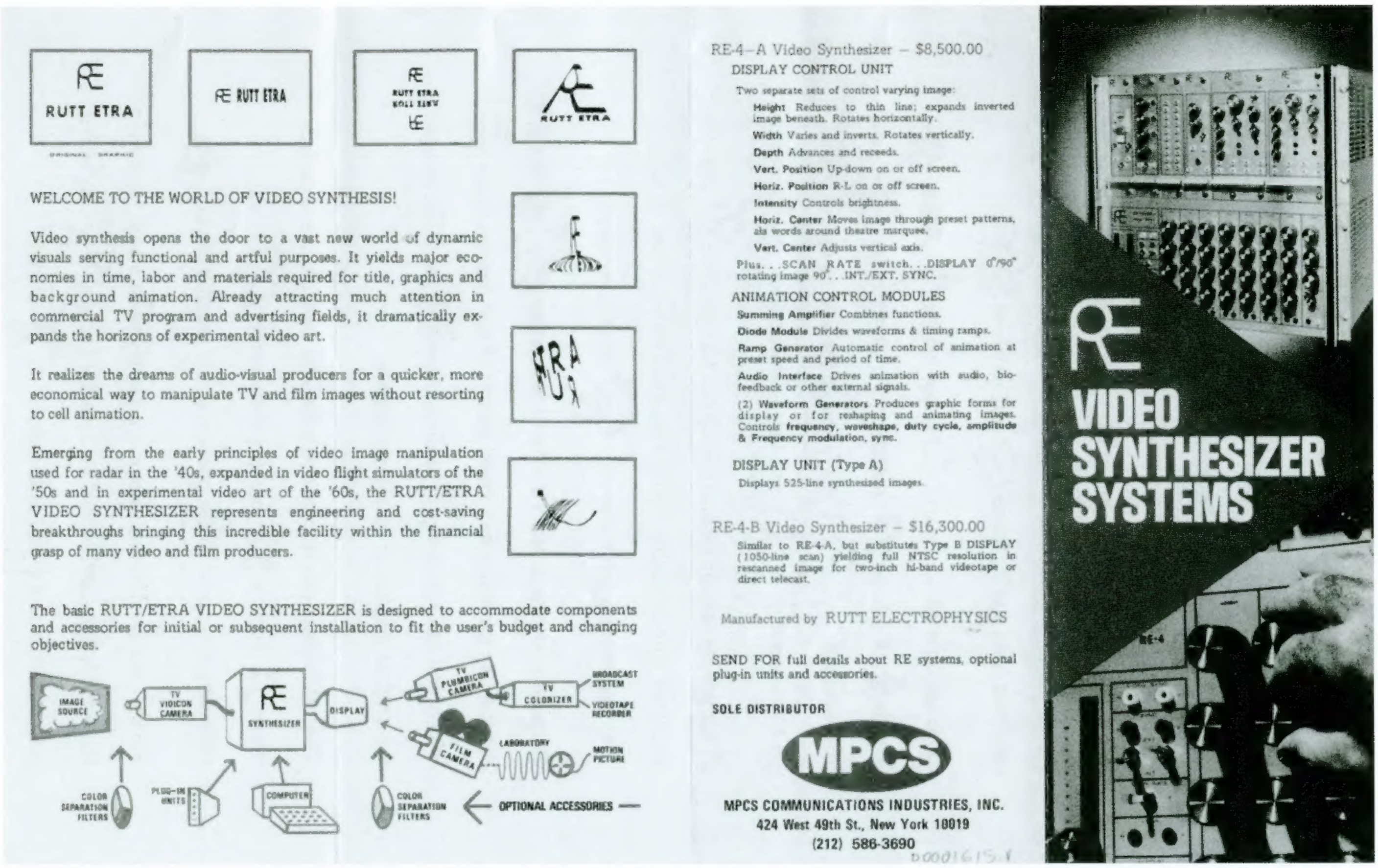
Bill Etra and Steve Rutt, Rutt/Etra Scan Processor, 1973



Bill Etra and Steve Rutt, Rutt/Etra Scan Processor (detail), 1974



George Brown, Horizontal Frequency Drift Clock, 1971



Advertising material for the Rutt/Etra Scan Processor, 1973

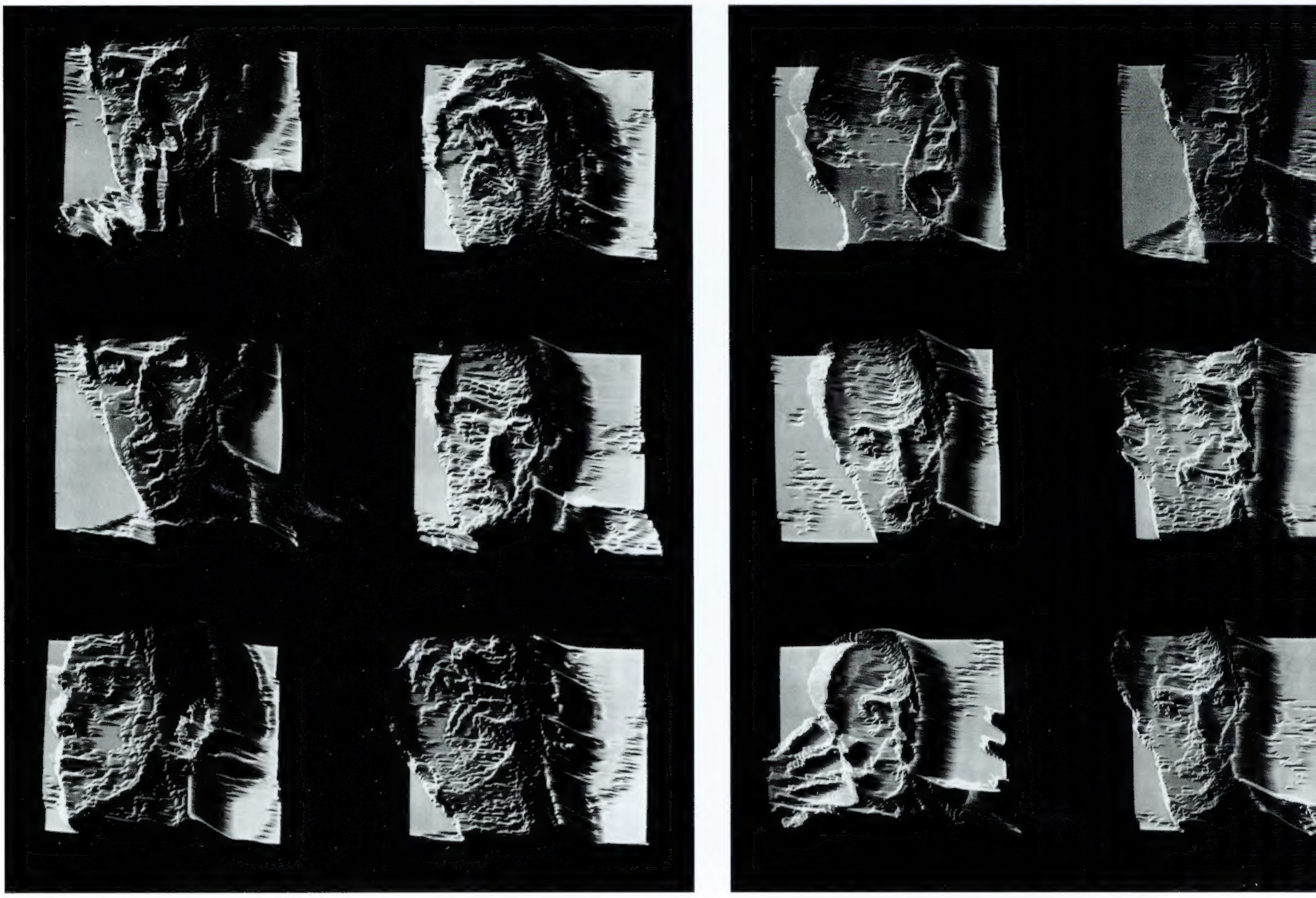
Introduction

Woody Vasulka's current work in video synthesis, here recorded in photographs, leads into a conceptual space of waveform encoding and processing operations. His previous works in videotapes, made cooperatively with Steina Vasulka, included a parody and homage to surrealism (*Golden Voyage*), and retinal-activating imagery (as in *Key Snow*). The interest here, however, is not in mental or perceptual space as such, but in time-energy principles that lie behind video's reconstruction of a visible world.

The aspect of video important to the development of these images is the light/code interface: between the segment of the electromagnetic spectrum we perceive as light, existing external to the video system, and the electronically encoded signal or waveform internal to the system. That interface normally takes place at a camera, which organizes visible reality into linear perspective by means of the camera obscura principle (dating back at least to Leonardo da Vinci) – demonstrable by a pinhole in window shade, through which an inverted image of the outside world may be projected on the opposite wall of a darkened room. Video synthesizers, however, make possible the development of non-camera imagery, so that the electronic/light interface occurs only at the monitor, when the wave form is displayed as a visible image.

The basic character of these images is imprinted in the tool from which they are derived – the Rutt/Etra scan processor, one of several current designs for video synthesizers (others include Paik/Abe, Dan Sandin's and Stephen Beck's). The Rutt/Etra reorganizes imagery by electromagnetic deflection of the electron beam; deflection coils form a yoke surrounding a monitor built into the synthesizer. The resulting images can only be recorded by means of an external camera, since the waveform display, or raster image, alone is altered, not the waveform code directly. Yet despite the specific nature of the machine, inevitably personal aesthetic preferences develop with its use. The aesthetic here is specifically didactic: to visually display, as clearly as possible, the step-by-step development of very primitive, basic modes of information available with this synthesizer. Accordingly, sine, triangle, or square waves are used as the bases for most images. The didactic purpose involved is to enable the principles of time-energy construction to become common knowledge, as a primary conceptual and technological tool of our evolving electronic society.

This mode of imagery is rarely seen, and verbal language does not yet adequately exist for it. Engineers, mathematicians, psychologists, and artists – among others – all have information which applies to the conceptualization of the electronic image, and a synthesis is not yet formed. These words, then, are an initial, tentative attempt to rationalize images that are themselves still just beginning to be generated. *(Scott Nygren)*



Woody Vasulka, *Polaroids from Rutt/Etra Scan Processor*, mid 1980s, shot from Rutt/Etra display

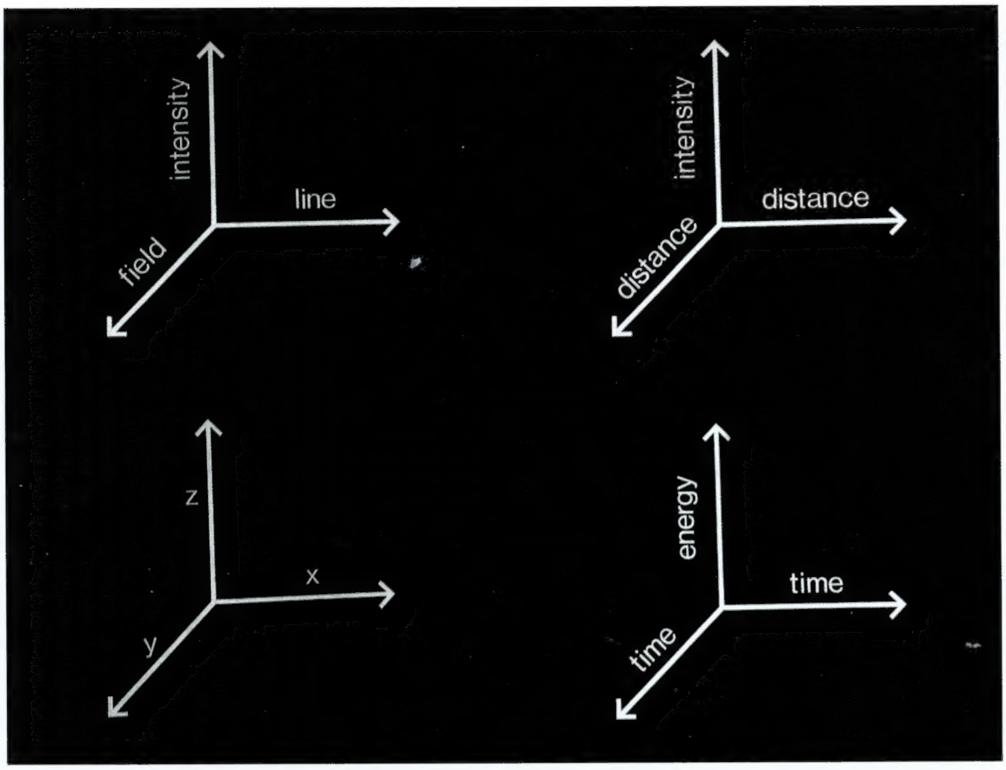
Statement

These time segments (tableaux I to IV) belong to a larger work titled *Time/Energy Structure of the Electronic Image*, dating from 1974 through 1975. The images are produced on a scan processor (Rutt/Etra Model-4, Rutt Electrophysics Inc.), a tool providing various means of reprogramming electromagnetic conditions around its display (cathode-ray tube or CRT).

Compared to my previous work on videotape, the work with the scan processor indicates a whole different trend in my understanding of the electronic image. The rigidity and total confinement of time sequences have imprinted a didactic style on the product. Improvisational modes have become less important than an exact mental script and a strong notion of the frame structure of the electronic image. Emphasis has shifted towards recognition of a time/energy object and its programmable building element – the waveform.

The majority of images, still or moving, are based on their capture from the visible world with the help of the camera obscura principle through a process involving the interaction of light with a photo-emulsion surface. The conversion of light into a code occurs simultaneously at each part of the emulsion in exposure time. Contrary to this, the conversion of light into energy potentials during electronic image forming is achieved sequentially, giving particular significance to the construction of the referential time frame. (The single value on the pick-up tube has to possess exact time coordinates in order to be reproduced in the identical position on the display). The organization of energy components even in a television camera is of course provided by the camera obscura present in front of the image pick-up tube.

The possibility of disregarding this organizational principle and realizing instead a total absence of such a process in certain modes of electronic image forming has interested me the most. The result has been an inevitable descent into the analysis of smaller and smaller time-sequences, a process necessary to understanding wave formations, their components, and the process of their synthesis and programmability. To me this indicates a point of departure from light/space image models closely linked to and dependent upon visual-perceptual references and maintained through media based on the camera obscura principle. It now becomes possible to move precisely and directly between a conceptual model and a constructed image. This opens a new self-generating cycle of design within consciousness and the eventual construction of new realities without the necessity of external referents as a means of control. *(Woody Vasulka)*



Some alternate descriptions of the x-y-z grid, here appearing as if tilted back in illusionary three-dimensional space

The Images

The photographs reproduced here are records of raster displays from the modified monitor built into the scan processor hardware. These illustrations are organized into four tableaux (I-IV), within each vertical series (A–C) indicates a time sequence (1–5, or 1–4).

The first figure (I-A-1) is a sine wave derived from a waveform generator, and displayed as if on an oscilloscope.

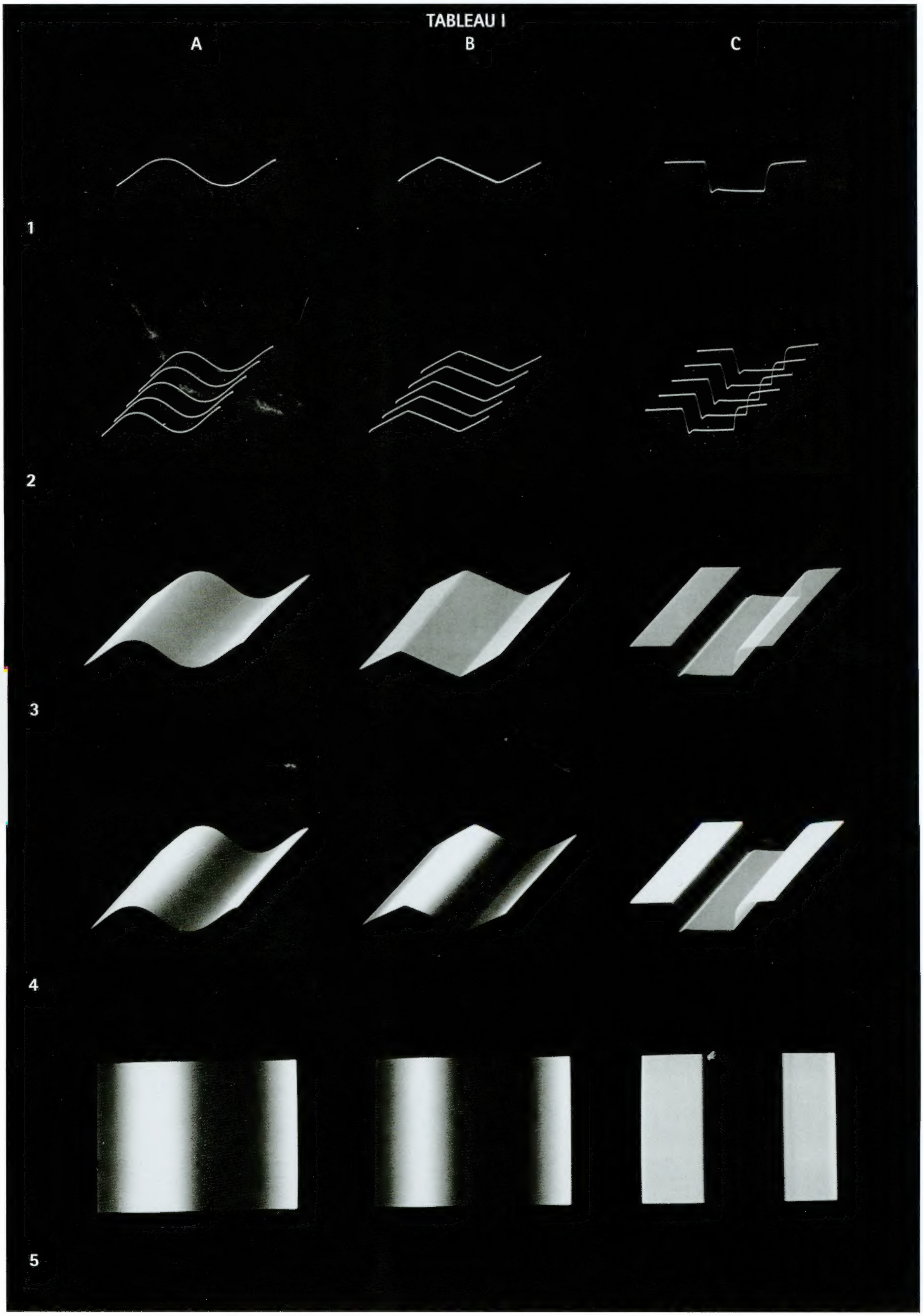
The sine wave is manipulated by means of the scan processor to generate the following images in the first series. To analyze more precisely how this is done it is helpful to posit an x-y-z three-dimensional grid, in which the x-axis represents horizontal, the y-axis represents vertical, and the z-axis intensity or brightness. The video raster or screen consists of 525 horizontal lines, half of which are scanned in vertical sequence – the electron beam tracing alternate lines – to form a single field. Two fields make a whole image, since the electron beam in its next sweep traces the lines omitted in the first field. A whole image is traced each 1/30 second, a field each 1/60, and a line each 1/15750 second. Hence, the x-axis may also be described as the line [illegible] y-axis as the field axis; x and y describe different units [illegible] with y slower than x), and z indicates energy or intensity [illegible] ne-energy grid.

What is happening, then, in figure I-A-1, is that a single line display of a sine wave is modified to show the wave's energy form (z) as height (y), making the oscilloscope-like image. In figure I-A-2, the sine wave is repeated in a diagonal series four additional times within the field, and in I-A-3, this repetition or extension becomes continuous, completing an illusion of three-dimensional space. In figure I-A-4, the sine wave is simultaneously used to trigger brightness, modulating gray levels in proportion to the rise or fall of the wave form; this creates an illusion of shading, as if cast by an external light source. Finally, in figure I-A-5, the borders of the illusionary warped plane are repositioned to coincide with the borders of the TV frame, so that the sine wave coincides with the x-axis, modulating brightness (z-axis) to create a vertical dark band (y-axis). I-B and I-C follow the same operations, but beginning with triangle and square waves, respectively.

What is astonishing here is the ease with which a two-dimensional raster can take on the appearance of a three-dimensional object. Moving backwards from 5 to 4 in each series of Tableaux I and II, we can see that the video raster can be relocated in illusionary space so that brightness is displayed as illusionary height. An energy/space relationship is herein described: light by means of a time-energy code can become a building material for architectural space.

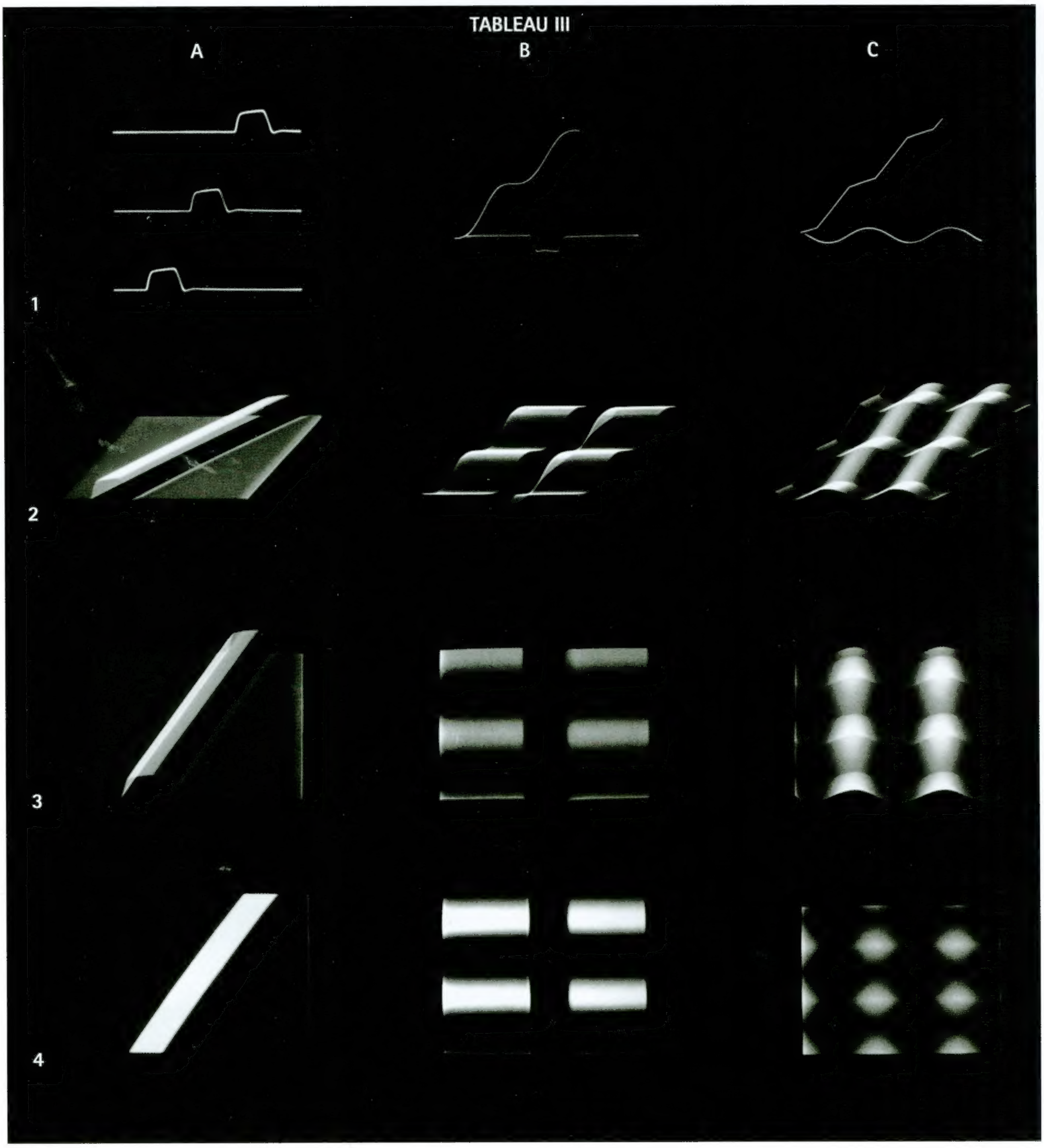
In the Tableau II, the organization of energy – sine, triangle, square waves – and the processing operations are identical with those in I. What's changed is the rate of reproduction: the apparently simple shift from horizontal to vertical display, because of the time-energy nature of the raster, actually indicates a radical shift in timing. Vertical is much slower. For example, in figure II-A-5, the horizontal dark band coincides with a group of lines, and is hence read out once each field, or 1/60 second. The apparent horizontal band is caused by a vertical (y-axis) sine wave; when an x-axis sine wave causes a vertically appearing band, as in figure I-A-5, each horizontal raster line must read out a section of the dark band, once each 1/15750 second.

The redundancy of waveform sources and processing operations throughout the first two tableaux are designed to visually clarify those operations on a step-by-step basis, and lay down a primitive vocabulary of sorts, by which more complex or varied image information may be analyzed.



Impact of waveforms at line frequency

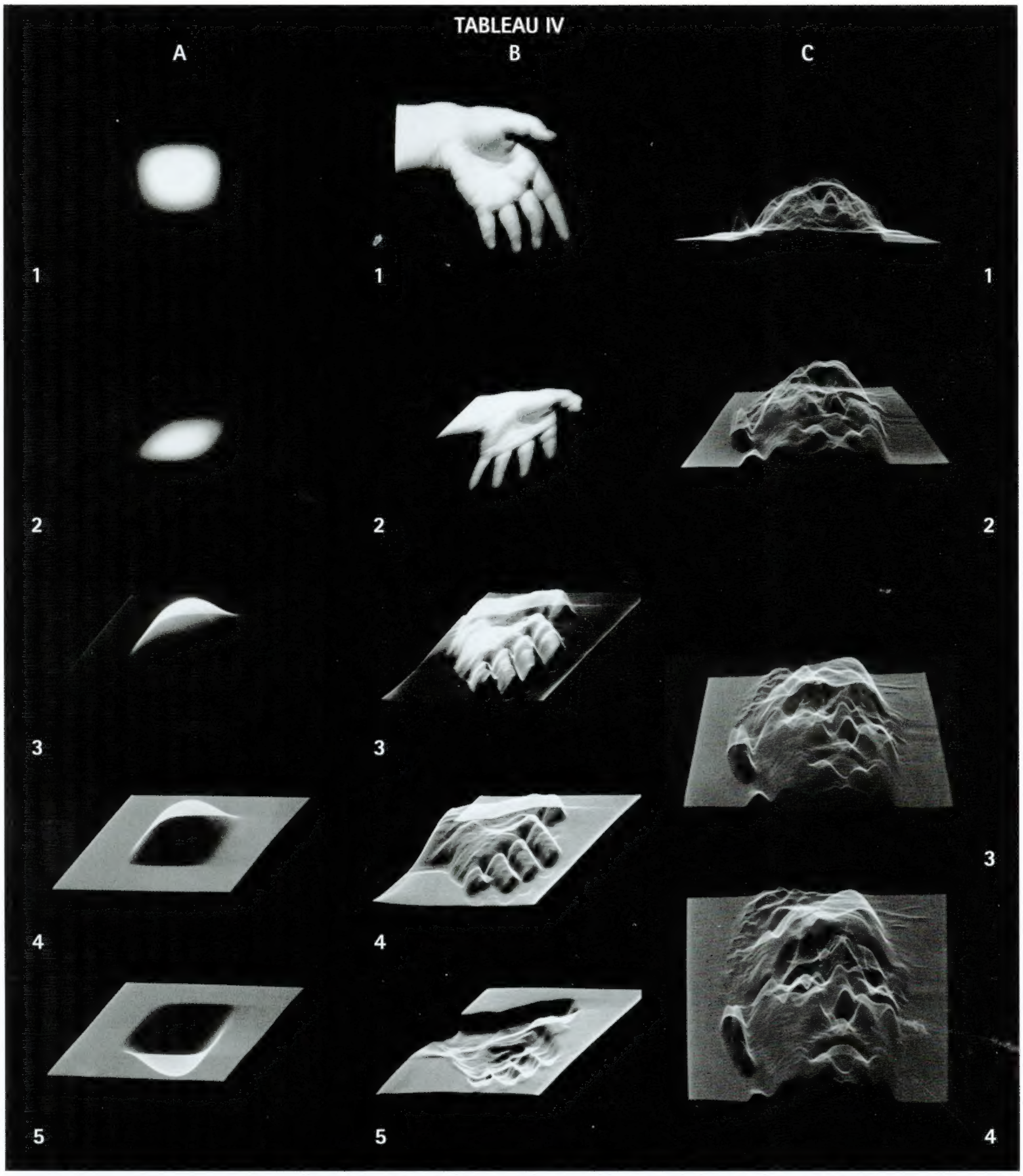
Impact of wave-
forms at field
frequency



Impact of waveforms at line/field frequency

In Tableau III, the first series is like I-C in that a horizontal square wave is the signal input, but differs in that this source is retimed on each line in relation to the field rate. The result, as sampled in the three figures of III-A-1, is similar to I-C-2, except that the position of the square pulse is relocated within each line display of the whole wave. This relocation is determined by the placement of the line display within the vertical field. The square pulse is positioned within the wave by controlling entry rates, or beginning times, of the wave in line display by a field-locked ramp, or triangle wave. The result, when processed as before for extension, tilt, and shading, is a diagonally shaped surface. In figure III-A-3 the illusionary plane is tilted forward, and in 4, the y displacement of z in illusionary space is flattened back into brightness, making a white bar. Beyond this, curved shapes could be programmed by varying the same entry rates by non-linear forms (such as a sine wave).

In figures III-B, more complex illusionary space is created by means of two signal inputs. If x1, y1, and z1 describe the video raster as a two-dimensional surface, then x2, y2, and z2 may be used to describe the three axes of illusionary space appearing within the raster; so that x2 coincides with x1, but y2 is displayed as illusionary depth along an x1-y1 diagonal from upper right to lower left, and z2 is displayed as height, y1. (The basic difference is that z1 functions as

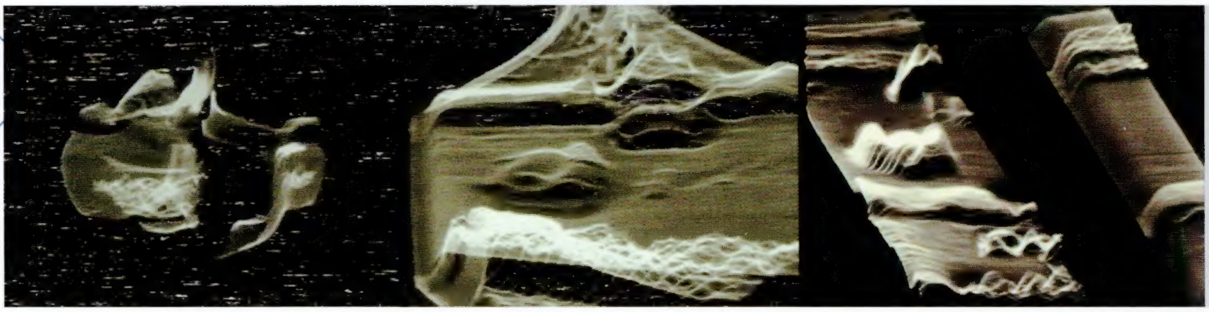


Study of synthetic principle A,B,C

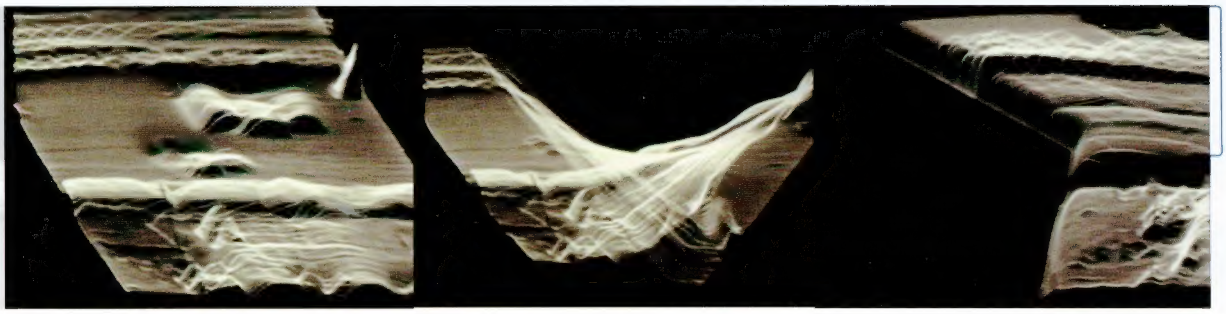
brightness, an invisible third dimension, on the raster, while z2 appears as height. It should also be noted that x2, y2, z2 describe a purely visual and illusionary space, which is derived by technical operations performed on the actual space, x1, y1, z1 of the raster.) In figures III-B, then, a square wave is the initial horizontal (x1 and x2) input and a sine wave is added as a diagonal input (y2). The square wave is processed as in I-C, and the sine wave as in II-A, so that the intersecting processes produce the irregular topographical surface of figure III-B-2, shaded as before. In figure III-B-3, the sine wave (y2) is repositioned vertically to coincide with y1, and in 4, the square wave is similarly altered to coincide with the horizontal. The result is a hard-edged vertical bar derived from the x-axis square wave, and soft-edged bars from the y-axis sine.

Figures III-C follow the same construction as figures III-B but with sine and triangle waves replacing the square and sine waves respectively. The resulting rounded shapes of figure III-C-4 are an interference pattern created by the coinciding periodicity of the two waves.

In Tableaux IV, operations are altered significantly, with an initial input of greater complexity than before. Figures IV-A begin with two sine waves – one horizontal (x, or line display), one vertical (y, or field display) – each extended across the frame, and constructed so as to appear as a soft bright rectangle. Figures IV-A-1 to IV-A-2 describe the same tilting process as from I-A-5 to I-A-4, causing the surface image to lay back in illusionary space. Figure IV-A-3 then uses the z-axis (brightness) to modulate vertical deflection (z2, or y1), completing an image in illusionary space parallel to figure I-A-4. In figure IV-A-4, brightness modulation



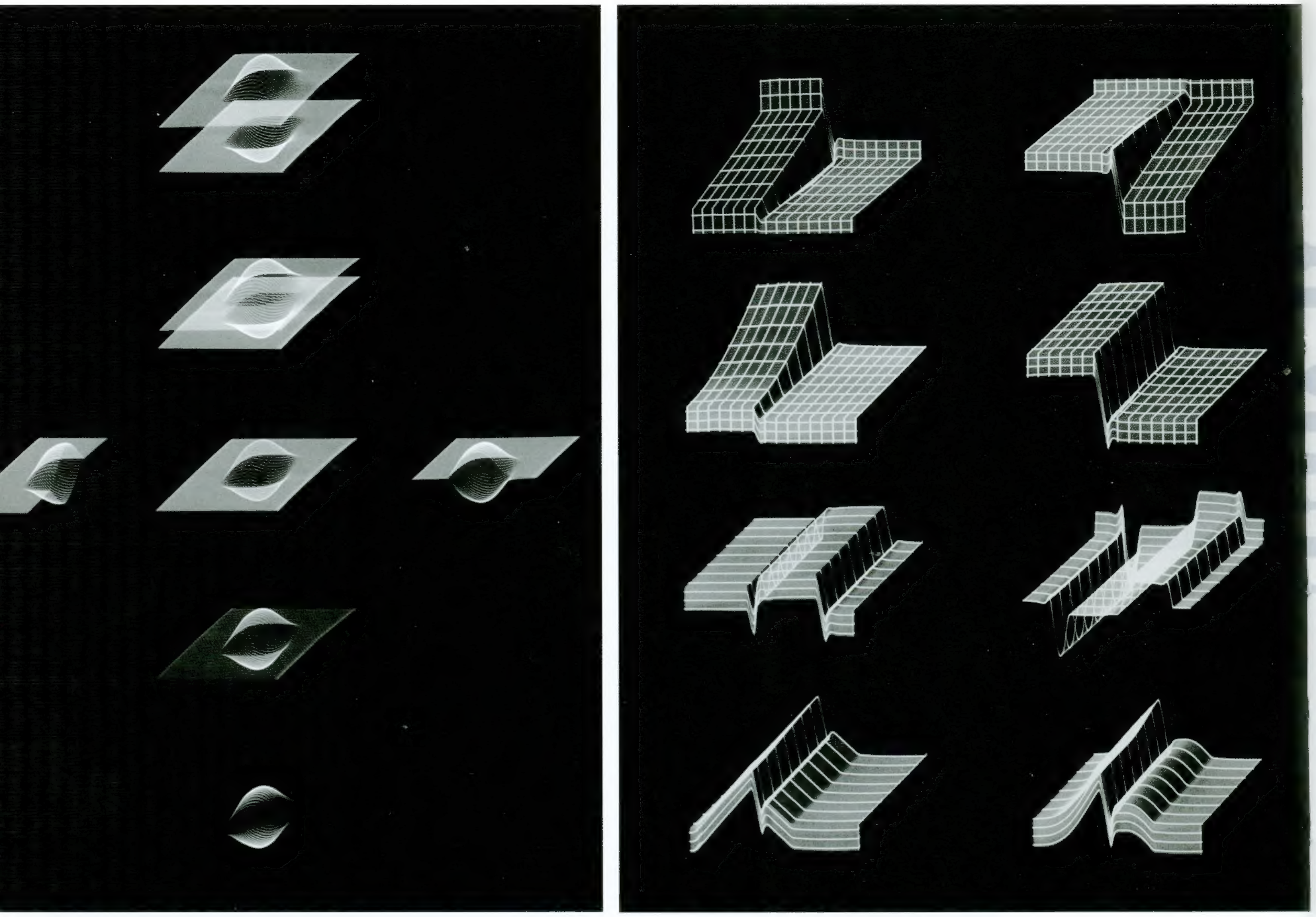
Woody Vasulka, *C-Trend*, 1974, ¾" U-matic video, color, sound, 8:30 min, stills from a digital copy



(z1) is then totally subtracted, leaving all lines of equal intensity so that the appearance of varying brightness is due only to the overlay of some vertically-deflected lines on others (z2). In figure IV-A-5, the polarity or directionality of the deflection system is reversed, so that the illusion of a convex surface becomes the illusion of a concave surface.

Figures IV-B follow an identical construction process except the initial image input comes from a camera (the hand image). This is technically simpler than figures IV-A, but creates a more complex, irregular image, and implies different aesthetic goals. This is the first input of conventional reality into a previously self-contained system of electronically generated and processed imagery, and should be understood as part of an electronic process. The narrow band of the electromagnetic spectrum which we perceive as light is first organized into linear perspective by means of the camera lens (the camera obscura principle), and projected as a two-dimensional model of visible reality onto the camera tube; this model is then converted to an encoded waveform by electron beam scanning, and redisplayed on a monitor (IV-B-1). What we see then, is an illusionary image of a hand, which is actually a raster display of a complex encoded waveform parallel to the sine wave of figure I-A-1. As a waveform, the image is susceptible to the same operations as before, and figures IV-B repeat the processing operations of figure IV-A.

The figures IV-C complete the synthesis of a reality-model image with a time-energy based illusionary object, and is most easily read from bottom to top. In IV-C-4 the reality model brightness is transformed to vertical deflection as before. In 3, the appearance of tilt is induced by different means: the y-axis is compressed (y2 only; the z1-generated height remains deflected as z2), while an appearance of perspective is created by inputting a triangle wave into the width control function of the scan processor. This triangle wave increases in slope or amplitude as compression of y2 increases (IV-C-2). This begins a construction of vanishing point or receding line perspective; the illusory depth in previous images has been purely isometric, or parallel line perspective. In figure IV-C-1, the original undeflected y-axis (y2) has been compressed to a single horizontal line, parallel to the horizontal display of waveforms in the first tableau, yet the y-axis display of what was originally brightness (z2) remains deflected and appears as an irregular, raised surface out of a flat plane.



Woody Vasulka, *Video Raster Studies*, from Rutt/Etra Scan Processor, mid 1970s

Media Study,
Media Practice,
Media Pioneers,
1973 – 1990

Buffalo Heads

Gerald O'Grady
Hollis Frampton
Paul Sharits
Woody Vasulka
Steina
Tony Conrad
James Blue
Peter Weibel

edited by Woody Vasulka and Peter Weibel